

Companions of Bright Barred Shapley Ames Galaxies

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ABSTRACT

Companion galaxy environment for a subset of 78 bright and nearby barred galaxies from the Shapley Ames Catalog is presented. Among the spiral barred galaxies there are Seyfert galaxies, galaxies with circumnuclear structures, galaxies not associated with any large scale galaxy cloud structure, galaxies with peculiar disk morphology (crooked arms) and galaxies with normal disk morphology; the list includes all Hubbles types. The companion galaxy list includes the number of companion galaxies within 20 diameters, their Hubble type and projected separation distance. Additionally, companion environment was searched for four known active spiral galaxies, three of them are Seyfert galaxies, namely, NGC 1068, NGC 1097, NGC 5548 and one is a starburst galaxy, M82. Among the results obtained it is noted that the only spiral barred galaxy classified as Sy 1 in our list has no companions within a projected distance of 20 diameters; 6 out of 10 Sy 2 bar galaxies have no companions within 10 diameters, 6 out of 10 Sy 2 galaxies have one or more companions at projected separation distances between 10 and 20 diameters; 6 out of 12 galaxies with circumnuclear structures have 2 or more companions within 20 diameters.

Subject headings: galaxies: spiral — galaxies: clusters: general — galaxies: Seyfert — galaxies:active

1. INTRODUCTION

Nearby barred spiral galaxies are important to study because they have a large scale stellar bar and are better resolved compared with barred galaxies which are small and distant. A non-axisymmetric gravitational potential can drive gas to flow from large to small radii (Combes 1988), yet not all barred galaxies present a similar level of central activity. Bipolar nuclear outflows (as detected by their radio continuum emission) and circumnuclear structures are perhaps a result of gas inflow; in particular, circumnuclear structures are thought to be a result of a dynamical resonance between the pattern speed of the stellar bar and the orbital motion of gas and stars in the disk, generally known as Inner Lindblad Resonance (Binney & Tremaine 1987, Buta & Combes 1996).

The connection between nuclear activity and the properties of the parent galaxy is still under investigation. The level of central (or nuclear) activity in galaxies is thought, in general, to be mainly due to: a) merger events, (ie. ellipticals - radio galaxies [Toomre & Toomre 1972, Toomre 1977], ultra luminous infrared galaxies [Sanders & Mirabel 1996]); b) tidal effects, (e.g., similar size nearby companions, [Salo 1991, Noguchi 1988]); c) non-axisymmetric gravitational potential (e.g., stellar bars); d) minor mergers (with small galaxy satellites, [Walker, Mihos & Hernquist 1996]). The central activity in spiral galaxies is thought to be mainly due to the last three mechanisms.

The issue of the role of bars may play on this process has been the subject of several investigations (Combes 1988, Shlosman et al. 1989, Athanassoula 1992, Phinney 1994, Athanassoula 1994, Wada & Habe 1995, Ho, Filippenko & Sargent 1996, Mulchaey, Regan & Kundu 1997, Sakamoto et al. 1999, Sakamoto, Baker & Scoville 2000, Combes 2000, Combes 2003). However, a conclusive link between bars and nuclear activity has not yet been established (Combes 2000, Combes 2003). One way to further investigate this possible link is to focus not on how frequently active spiral galaxies are barred, but on studying the properties of barred galaxies: for example, the strength of the stellar bar, the frequency of companions, the atomic and molecular gas content, the group membership and the possible existence of intergalactic gas capable of gas stripping as the barred galaxy travels, the radio continuum bipolar outflows, etc. In this paper we concentrate on the frequency of companions to barred galaxies. This would tell us if tidal interactions are important with respect to the issue of activity in barred galaxies or if there are other factors involved.

Seyfert galaxies are found to be barred spirals of 79% in the CfA sample (Knapen, Shlosman & Peletier 2000) which suggests that a non-axisymmetrical gravitational potential might be relevant to the activity. From statistical analysis the issue of large-scale companions near Seyfert galaxies is still controversial but different studies indicate that Seyfert 1 galaxies do not have an excess of companion galaxies, while Seyfert 2 galaxies have a significant excess of large companions within a radius of 100 kpc (Laurikainen & Salo 1995, Dultzin-Hacyan et al. 1999). This result suggests that tidal interaction with a galaxy of similar size may induce central activity; tails, as in the best example of tidal interaction between galaxies of similar size, are observed in the Antennae and M51 systems (Toomre & Toomre 1972). Observationally, it is very difficult to detect companions of small dimensions and mass compared to the parent galaxy (Ibata, Gilmore & Irwin 1994, Ibata et al. 1997); there are, however, observations of several galaxies suggesting that the observed morphology is the result of a merging event of a large (parent) galaxy and a minor galaxy in dimensions and mass (e.g., M 101 [Waller et al. 1997]; NGC 7479 [Laine & Heller 1999]; NGC 2110 [Gonzalez Delgado et al. 2002]).

In this paper, we ask the following question: How many galaxy companions are there within a distance of 10 and between 10 and 20 diameters (D_{25})³ of a given barred galaxy? What Hubble type is each companion galaxy? At what projected distance is the companion galaxy from the barred galaxy under study? For this purpose we have searched for companions, extracted from NED⁴ with the following criteria: a) the first and strongest criterium is that their distance was chosen equal or less than 20 diameters from each galaxy in our study; b) for large-scale clouds of galaxies, the systemic velocity of a companion should not differ from that of the barred galaxy in question by more than twice the measured velocity dispersion of the cloud. If the cloud has no measured velocity dispersion, then the velocity difference needs to be less than 300 km s⁻¹ as discussed by Tully (1987); c) third, no attention was given to the visible magnitude of the companion. The sample of 78 barred spirals, from the Shapley Ames Catalog, includes 2 SB0, 9 SBa, 1 SBab, 17 SBb, 17 SBbc, 22 SBc, 2 SBd, 3 SBm, 1 SB(r), and 1 SB(ate). Of them 1 is Seyfert 1, 10 are Seyfert 2, 1 is Seyfert 2-like, 7 have circumnuclear structures, 11 have peculiar disk morphology (e.g., crooked arms [García-Burillo, Combes & Gerin 1991]), 10 galaxies are not associated with any large scale galaxy sub structure (according to Tully[1987,1988=T88]) and 38 have normal disk morphology; they all are in the distance interval 2.2 Mpc $\leq D \leq$ 53.2 Mpc. This subset of barred galaxies is not complete to any limiting distance or apparent magnitude, but it is a representative subset of nearby barred spiral galaxies with different Hubble types and members of different cloud or group associations. This sample was originally chosen based on far infrared (IRAS) colors ($\log[f12/f25] \leq -0.15$ and $\log[f60/f100] \leq -0.1$) indicative of central star formation (after Helou 1986) or relatively warm dust (IRAS) temperature, $T_d \geq 29$ K, (García-Barreto et al. 1993, García-Barreto et al. 1996) at $\delta \geq -41$. The study of "bar galaxies and their environment" by van den Bergh (2002) focused in assigning each of all northern Shapley Ames galaxies to either field, group or cluster environment. We believe that our approach has the advantage over van den Bergh's study by giving a list of names of companions, their Hubble type, systemic velocity and projected distance from 78 Shapley Ames barred galaxies.

Table 1 lists group membership and (cosmological) distances (using $H_0 = 75$ km s⁻¹ Mpc⁻¹, T88) and Tables 2 and 3 list the projected linear separations (based on angular distances estimated from NED) to each nearest large scale neighbor galaxy (using systemic velocity information from T88 and NED).

³A projected distance of 20 D_{25} diameters from a given barred galaxy is somewhat arbitrary; it is a large enough distance in order to have an estimate of companions: for a galaxy with $D_{25} = 3'$ at 40 Mpc, 20 D_{25} would be ~ 700 kpc. Bergvall, Laurikainen & Aalto [2003] consider an isolated galaxy as a galaxy having no neighbors (with magnitude difference ≤ 2 magnitudes) closer than 6 diameters and having no more than 2 neighbors within 16 diameters. Tully[1987] considers an isolated galaxy if there are no companions within 6 Mpc.

⁴This research has made use of the NASA/IPAC Extragalactic Database (NED) which is operated by the Jet Propulsion Laboratory, California Institute of Technology, under contract with the National Aeronautic and Space Administration

1.1. Tully’s Group Terminology

Since we refer to the group assignment of each galaxy according to T88, a brief description of his terminology⁵ is in order: a) a galaxy is part of a group under the density criterion based on luminosity and distance separation as $\rho = LR_{ij}^{-3}$, specifically $\rho_g = 2.5 \times 10^9 L_\odot Mpc^{-3}$; b) galaxies can be associated on two levels, i) at first level there are entities that failed the criterion for a group but passed the criterion for association, $\rho_g = 2.5 \times 10^8 L_\odot Mpc^{-3}$; ii) at a second level, several groups or first level associations of individual galaxies may link together at densities that satisfy the definition of an association; c) a galaxy is assigned to a structure identified by $xx \pm yy \pm zz$, where xx refers to a Cloud or Spur, $-yy$ refers to a group, $+yy$ refers to a first level association and $+zz$ refers to a second level association; d) a galaxy identified with a cloud that is not associated with any substructure would have group assignment $xx-0$ (ie. NGC 2525 has group assignment 31-0 in the Antlia-Hydra Cloud); groups and associations within a cloud are numbered in order according to their proximity to the prominent structure within a cloud (e.g., NGC 4477 has a group assignment 11-1 which means it is within the Virgo Cluster, while NGC 1415 has a group assignment 51-4+4 which means that it is a little away from the Fornax Cluster [~ 4 Mpc away]; e) if a galaxy in the general region X cannot be associated with any cloud, then it has the group assignment $x0 \pm yy$ where $yy=-0$ is given if the galaxy is not in a group or association (e.g., NGC 6951 has group assignment 40-0 in the Leo Clouds); f) a galaxy is called isolated if it is farther than 6 Mpc from any high probability member.

Table 1 lists the barred galaxies in our study; the table is divided in five groups, namely, galaxies with Seyfert activity, galaxies having circumnuclear structures, galaxies with peculiar disk morphology, galaxies not associated with any large scale (cloud) substructure as defined by T88 and galaxies with normal disk morphology. Table 2 lists the number of companions extracted from NED according to angular separation and systemic velocity (see below). Table 3 lists a summary of Table 2 with number of companions from every barred galaxy in our study within 10 and between 10 and 20 parent galaxy diameters.

2. RESULTS

Gas flow is a necessary condition for nuclear or central activity, a condition which could be satisfied by a large-scale stellar bar. However evidence linking actual bars to nuclear activity has been weak (Sakamoto et al. 1999, Combes 2000, Sakamoto, Baker & Scoville 2000, Combes 2003, Martini et al. 2003). Observational evidence of (stellar and gas) long tails or optical morphology deformation as of the type of the antennae was shown to be the result of tidal interaction or a recent major merger event (Toomre & Toomre 1972, Rots et al. 1990, Tyson et al. 1998, Salo & Laurikainen 1999a, Salo & Laurikainen 1999b, Hibbard 2000). Numerical simulations indicate that merging of two spiral disks of equal mass might result in a completely different stellar population, for example a galaxy with shells (Hernquist & Spergel 1992). Long exposure optical images of the spiral galaxy NGC 5548 (SA0/a) classified as Seyfert 1.5 shows a long, low surface brightness structure suggesting that its origin could have been the result of a major merger (Tyson et al. 1998).

⁵For a complete description of group terminology please refer to Tully[1987]

Only one of the galaxies in our study presents a large scale long HI tail (Hogg & Roberts 2001), namely NGC 6239, a galaxy not associated with any large scale (cloud) substructure, and no large scale companion within 20 diameters.

Our study identifies companion galaxies only within certain projected distances and having similar systemic velocities as each barred galaxy in our list; true spatial separations remain to be estimated as distances to each individual barred galaxy and companion are determined (see below for M82 system).

Tables 2 and 3 indicate that the one Sy 1 galaxy, NGC 3783, has no large scale companions within a distance of 20 diameters ($38'$ [425 kpc]); 6 out of 10 Sy 2 galaxies have no companions within 10 diameters; 7/10 Sy 2 galaxies have one or no companions and 3/10 Sy 2 galaxies have three or more companions within a separation distance between 10 and 20 diameters; 3 Sy 2 galaxies show circumnuclear structures with no companions within 10 diameters, 1 Sy 2 galaxy has one companions at a distance between 10 and 20 diameters 1 Sy 2 galaxy has four companions at a distance between 10 and 20 diameters. The only Sy 2-like galaxy has no companions within 10 diameters and one companion within a separation distance between 10 and 20 diameters and yet it presents a bipolar radio continuum emission with large scale (12 kpc in diameter) lobes straddling the nucleus (García-Barreto et al. 1998, García-Barreto et al. 2002). From the group of galaxies with circumnuclear structures (CNS), 6 out of 12 have 1 or more companions at distances within 10 diameters and 6/12 have 2 or more companions within a distance between 10 and 20 diameters. From the group of galaxies with peculiar disk morphology (PM), 7/14 have no companions, 4/14 have one companion within 10 diameters; 11/14 have one or no companions and 3/14 have two or more companions within a distance between 10 and 20 diameters. From the group of galaxies not associated with any large scale (cloud) [NA] substructure 10/13 have no companions within 10 diameters, 9/13 have no companions and 4/13 have 1 or more companions within a distance between 10 and 20 diameters. From the group of galaxies with normal disk morphology (ND), 11/38 have no companions, 13/38 have 1 companion and 14/38 have 2 or more companions within 10 diameters, 12/38 have no companions, 10/38 have 1 companion and 16/38 have 2 or more companions within a separation distance between 10 and 20 diameters. Figure 1 shows two histograms one with number of Seyfert 2 galaxies versus number of companions, the other, with galaxies with circumnuclear structures versus number of companions. Figure 2 shows the corresponding histograms for galaxies with peculiar morphology and normal disk morphology. Finally Figure 3 shows the histogram of galaxies not associated with any large scale cloud structure versus the number of companions.

As seen in Table 3 the galaxies with more companions within 20 diameters are NGC 4435 (SB0), NGC 4535 (SBc) and NGC 4654 (SBc) which are in the Virgo cluster of galaxies and present *normal* disk morphology. The galaxies having circumnuclear structures NGC 1326, NGC 1415, NGC 3351, and NGC 4314, have 7 or more companions within 20 diameters; each of them belongs to a group of galaxies.

As an extension (check) of the method used for finding the companions of barred galaxies we have done a similar search for 4 known spiral galaxies that exhibit different central activity; these galaxies are NGC 1068, NGC 1097, M82 and NGC 5548. These galaxies are listed in Table 4. Companions to these galaxies are listed in Table 5 and a summary of companions to these galaxies within a separation distance less than 10 diameters and between 10 and 20 diameters is in Table 6. NGC 5548 type (R')SA(s)0/a, X-ray emitter and Sy 1.5 galaxy has no companions within 10 diameters and 3 at

projected separations larger than 300 kpc; NGC 1068, Sy 1, has one companion at 43 kpc ($10''.2$) and two others at projected distances more than 300 kpc; NGC 1097, Sy 1, has one companion at 14 kpc ($3''.4$) and two others at 195 and 303 kpc; M82, a starburst galaxy, has 6 companions within 10 diameters and 7 more at projected separations from 121 kpc to 204 kpc.

All companions found for our list of barred galaxies are considering projected distances but one must be aware that true spatial distance to companions remain to be determined on a case by case basis; M82 system is a good example when one is considering the question: is the projected separation distance representative of the true spatial distance separation? M82 has, among others, the companions M81 and NGC 3077 at projected separations of only 39 kpc and 73 kpc respectively assuming that M82 is at the cosmological distance of 3.6 Mpc as M81; however, M82 and NGC 3077 previous cosmological distance were estimated to be 5.2 Mpc and 2.1 Mpc, respectively (T88). The detection of HI in the system M81, M82, NGC 3077 (Yun, Ho & Lo 1994) supports the idea that the three galaxies are at the same (cosmological) distance as M81 as determined by HST Cepheids (Freeman et al. 1994); true spatial distances, though, remain to be estimated after cosmological distances to M82 and NGC 3077 are determined individually.

3. CONCLUSIONS

We have made a detailed study of likely physical companions to a sample of 78 nearby barred spirals, initially chosen on the basis of IRAS properties and fairly representative of bright barred spirals. We do not find a strong correlation between the presence of a companion within 10 or 20 projected diameters and nuclear activity in these barred galaxies. Histograms indicate a wide range of companion numbers for each of our subcategories of barred galaxies. Nuclear activity (as Seyfert type) in barred galaxies is not necessarily due to an enhanced presence of companions to these galaxies, a result which is in agreement with other studies indicating that for Seyfert 1 galaxies there is no clear evidence of any excess of companion galaxies within 100 kpc or within 3 diameters (Dultzin-Hacyan et al. 1999); in fact, the only Seyfert 1 galaxy in our study, namely, NGC 3783, has no companions within a projected separation of 20 diameters or 425 kpc. Six out of ten Seyfert 2 galaxies (Seyfert 2 galaxies are thought to have companions within a search radius of 100 kpc [Dultzin-Hacyan et al. 1999]), in our study, have no companions within a projected distance of 10 diameters, three barred Sy 2 galaxies have no companions between 10 and 20 diameters, two barred Sy 2 galaxies have one companion between a distance of 10 and 20 diameters, and one barred Sy 2 galaxy has two companions between 10 and 20 diameters. Finally our study suggests that having a large-scale stellar bar and nearby companions are not sufficient for a spiral galaxy to present nuclear activity: at present it is beyond the scope of this paper to explain why barred galaxies not associated with any large scale cloud of galaxies and therefore no companions do not present nuclear activity as does the only Seyfert 1 in our study, NGC 3783 (which has no companions); or for that matter explain why NGC 4435 or NGC 4535, two barred galaxies with the most number of companions do not present any nuclear activity (in case tidal interactions was an important mechanism). In a forthcoming paper we will present major and minor diameters of large scale stellar bars from 46 nearby bright barred galaxies; this could be another factor for the difference in activity in barred spirals.

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Table 1: Shapley Ames Barred Spiral Galaxies

Galaxy NGC/IC	Hubble Type	Characteristic ^a	Tully's Group^b	Distance Mpc
N 3185	SBa(s)	Sy 2	21-6+6	21.3
N 3367	SBc(s)	Sy 2-like, CNS, PM	32-4+4	43.6
N 3783	SBa(r)	Sy 1	31+11+10	38.5
N 4477	SBa	Sy 2	11-1	16.8
N 4507	SBab(rs)	Sy 2	-	45.0
N 4725	SBb(r)	Sy 2	14-2+1	12.4
N 5135	SBb	Sy 2, CNS	-	53.2
N 5347	SBb(s)	Sy 2, CNS, NA	42-0+1	36.7
N 5728	SBb(s)	Sy 2, CNS	41+15+15	42.2
N 6217	RSBbc(s)	Sy 2, NA	44-0+5	23.9
N 6951	SBb(rs)	Sy 2, CNS, NA	40-0	24.1
N 7479	SBbc(s)	Sy 2	64-2+1	32.4
N 1022	SBa(r)	CNS	52-1+1	18.5
N 1326	SBa	CNS	51-1+1	16.9
N 1415	SBa	CNS	51-4+4	17.7
N 3318	SBbc	CNS	31-6+6	37.9
N 3351	SBb	CNS	15-1+1	8.1
N 4314	SBa	CNS	14-1+1	10.0
N 5430	SBb	CNS	-	38.0
N 3319	SBc(s)	PM	15+7	11.5
N 1637	SBc	PM	53-20+20	8.9 ^c
N 2139	SBc(s)	PM	34+1	22.4
N 2798	SBa(s)	PM	21-6+16	27.1

Table 1: Shapley Ames Barred Spiral Galaxies

Galaxy NGC/IC	Hubble Type	Characteristic ^a	Tully's Group^b	Distance Mpc
N 4618	SBbc(rs)	PM	14-4	7.3
N 5534	SBbc	PM	-	35.0
N 5597	SBc(s)	PM	41-14+14	38.6
N 5691	SBb	PM	41-2+1	30.2
N 5757	SBb(rs)	PM	41+15+15	39.5
N 5915	SBbc(s)	PM	41-10+10	33.7
N 6907	SBbc	PM	-	42.0
I 1953	SBbc	NA, PM	51-0+4	22.1
N 2525	SBc	NA, PM	31-0	21.1
N 2787	SBa(s)	NA	12-0	13.0
N 3359	SBc(s)pec	NA	12-0+1	19.2
N 4561	SBc	NA	11-0+1	12.3
N 4691	SB0	NA	11-0+10	22.5
N 5669	SBc(r)	NA	41-0+1	24.9
N 5921	SBbc(s)	NA	41-0+1	25.2
N 6239	SBc pec	NA	44-0	18.9
I 5273	SBc	NA, PM	61-0+16	16.0
N 672	SBbc(s)	ND	17-5+5	7.5
N 1784	SBbc(r)	ND	34+5+4	28.7
N 1832	SBb(r)	ND	34-3+3	23.5
N 2217	SBa(s)	ND	34-1+1	19.5
N 2223	SBbc(r)	ND	34-8+8	33.7
N 2336	SBbc(r)	ND	42-17+16	32.9
N 2339	SBc(s)	ND	30+1	30.9

Table 1: Shapley Ames Barred Spiral Galaxies

Galaxy NGC/IC	Hubble Type	Characteristic ^a	Tully's Group ^b	Distance Mpc
N 2366	SBm IV	ND	14-10	2.9
N 2545	SBbc(r)	ND	-	(45.1)
N 2835	SBc(rs)	ND	54-3+1	10.8
N 2935	SBb(s)	ND	3-12	30.6
N 3287	SBc(s)	ND	21-6	20.6
N 3504	SBb(s)	ND	21-7+7	26.5
N 3513	SBc(s)	ND	54-5+5	17.0
N 3686	SBc(s)	ND	21-1	23.5
N 3729	SB(r)	ND	12-1	17.0
N 3912	SB(late)	ND	13-9+9	30.0
N 3953	SBbc(r)	ND	12-1	17.0
N 3992	SBb(rs)	ND	12-1	17.0
N 4123	SBbc(rs)	ND	22-11+11	25.3
N 4214	SBm III	ND	14-7	3.5
N 4236	SBd IV	ND	14+10	2.2
N 4242	SBd III	ND	14-4	7.5
N 4385	SBbc(s)	ND	11-25+24	33.5
N 4435	SB0	ND	11-1	16.8
N 4487	SBc(s)	ND	11-14+10	19.9
N 4496A	SBm(rs)	ND	11-4+1	13.1
N 4535	SBc(s)	ND	11-1	16.8
N 4654	SBc(rs)	ND	11-1	16.8
N 4688	SBc(s)	ND	11+2+1	17.1
N 4902	SBb(s)	ND	11-30	39.2

Table 1: Shapley Ames Barred Spiral Galaxies

Galaxy NGC/IC	Hubble Type	Characteristic ^a	Tully's Group ^b	Distance Mpc
N 4981	SBbc(rs)	ND	11-17+10	27.8
N 5068	SBc(s)	ND	14+17	6.7
N 5792	SBb(sr)	ND	41+2+1	30.6
N 5850	SBb(sr)	ND	41-1	28.5
N 7640	SBc(s)	ND	65-4	8.4
N 7723	SBb(rs)	ND	63-6	23.7
N 7741	SBc(s)	ND	65-3	12.3

^a Main Characteristic: Sy: Seyfert type; CNS: circumnuclear structure; PM: peculiar disk morphology; NA: galaxies not associated with any substructure, according to Tully(1987,1988)[refer to section 1 for a brief description when a galaxy is associated to a group or spur]; ND : normal disk.

^b T88; first digit specifies one of seven regions in T88, the second digit identifies a specific cloud within the general region; for a complete description refer to section 1 of this paper and Tully(1987) 11: Virgo cluster; 12: Ursa Major cloud; 13: Ursa Major Southern Spur; 14: Coma I Sculptur cloud; 15: Leo Spur; 17: Triangulum Spur; 21: Leo cloud; 22: Crater cloud; 31: Antlia-Hydra cloud; 32: Cancer Leo cloud; 34: Lepus Cloud; 40: Leo clouds; 41: Virgo Libra cloud; 42: Canes Venatici Camelopardalis cloud; 44: Draco cloud; 51: Fornax cluster and Eridanus cloud; 52: Cetus-Aries cloud; 53: Dorado cloud; 61: Telescopium Grus cloud; 63: Piscis Austrinus cloud; 64: Pegasus cloud.

^c New Cepheid distance has been determined to be 11.7 Mpc (Leonard et al. 2003). This new distance does not modify any of the analysis in this paper.

Table 2: Large Scale Galaxy Nearest Neighbors^a

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation ^f kpc
N 3185	Sy 2	1237	124	N3190	Sa	1271	66
				N3187	SBc(s)	1521	70
				N3193	E2	1399	98
				N3177	SAb(rs)	1302	230
N 3367	Sy 2-like, CNS, PM	3045	0	N3391	S	2956	563
N 3783	Sy 1	2910					
N 4477	Sy 2	1263	715	N4479	SB0(s)	876	25
				N4473	E5	2244	62
				N4474	S0	1610	127
				N4461	SB0(s)	1931	150
N 4507	Sy 2	3525					
N 4725	Sy 2	1210	-	N4747	SBcd	1190	87
				Mrk 1338	E	1069	141
				KVG 1249+263	Irr	1225	146
				N4670	SB0/a	1069	431
				N4565	Sb(s)	1282	694
				UGCA 294	S0 pec	947	701
				N4562	SBdm(s)	1353	728
N 5135	Sy 2, CNS	4157		I4248	E	4133	218
				CEN77 09	Irr	4413	224
				N5152	SBb(s)	4147	472
				N5124	E6	3976	476
				N5153	E1	4281	483
				E444-G021	Sc	4265	515
				E444-G030	Sa	4225	670
N 5347	Sy 2, CNS, NA	2386					
N 5728	Sy 2, CNS	2780		N5744	Sa	2692	1190

Table 2: Large Scale Galaxy Nearest Neighbors^a

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation ^f kpc
N 6217	Sy 2	1359	-				
N 6951	Sy 2, CNS, NA	1426					
N 7479	Sy 2	2384	134	U12300	SBa	2294	650
				U12281	Sd	2568	1071
N 1022	CNS	1574	99	N 961	SBm(rs)	1300	216
				UGCA 038	SBm(s)	1327	242
N 1326	CNS	1364	434	N1326A	SBm(s)	1836	77
				N1326B	SBm(s)	1006	86
				N1316C	RSA0	1800	172
				N1317	RSAB0(rl)	1941	201
				N1316	RSAB0(s)	1760	231
				N1310	SBcd(rs)	1805	253
				N1341	SABab(rs)	1813	312
N 1415	CNS	1553	110	N1401	SB0(s)	1518	125
				N1426	E4	1443	193
				N1395	E2	1717	227
				N1414	SBbc(s)	1681	262
				N1422	SBab	1637	275
				N1438	SB0(r)	1555	336
				N1439	E1	1670	340
N 3318	CNS	2910	52	N3318B	SBc(s)	2756	113
				E318-G003	Sc	2767	521
N 3351	CNS	780	112	N3368	Sab(s)	897	99
				CGCG065-086	dS0	778	112
				N3379	E0	911	182
				1046+1234		887	186
				N3384	SB0(s)	704	199

Table 2: Large Scale Galaxy Nearest Neighbors^a

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation f kpc
N 4314	CNS	980	266	N3299	SABdm(s)	641	297
				N3412	SB0(s)	841	340
				N3377	E6	665	348
				N4308	E	624	40
				U7457	Sc	659	101
				N4274	Sa(s)	930	117
				N4286	SA0(r)	644	122
				N4310	RSAB0(r)	913	124
				N4283	E0	1076	136
				N4278	E1	649	145
				I3247	Sd	569	182
				N4245	SBa(s)	815	199
				N5402	S	3021	385
N 5430	CNS	2960					
I 1953	PM, NA	1859		E548-G034	SB	1664	163
				I1962	SBdm(s)	1806	186
				N1377	S0	1792	346
N 1637	PM	717	31				
N 2139	PM	1843					
N 2525	PM, NA	1585					
N 2798	PM	1744	124	N2799	SBm(s)	1865	12
				KTG 22	-	1799	23
				UGC 04904	SB	1670	43
N 3319	PM	744					
N 4618	PM	544	58	VV 073A	-	562	2
				N4625	SABm(rs)	609	17
				UGC 07751	Im	605	153

Table 2: Large Scale Galaxy Nearest Neighbors^a

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation ^f kpc
N 5534	PM	2633					
N 5597	PM	2683		N5595	SABc(rs)	2711	46
N 5691	PM	1870	136	SD:J143 ^g	Sd	300	
				N5705	SBd(rs)	1757	303
				N5713	SAB(rs)	1972	306
N 5757	PM	2678		E580-G034	SBc	2727	44
				E580-G029	Sb(r)	2596	476
N 5915	PM	2274	90	N5916	SBa(rs)	2302	43
				N5916A	SBc(s)	2292	45
N 6907	PM	3180		N6908	S		10 ^h
				I5005	SBcd(s)	3112	749
N 2787	NA	700		U4998	Im	623	222
N 3359	NA	1018					
N 4561	NA	1407					
N 4691	NA	1098					
N 5669	NA	1371		KUG142	BCD	1382	44
N 5921	NA	1480		N5921:[KSF97]B		1532	15
N 6239	NA	922					
I 5273	NA, PM	1320		E406-G040	Irr	1248	150
				E406-G042	SABm(s)	1375	232
				N7418	Sc(rs)	1446	247

Table 2: Large Scale Galaxy Nearest Neighbors^a

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation ^f kpc
N 0672	ND	408	57	I1727	SBm(s)	338	18
				[HKK97] L010	Irr	368	90
				LE166062	Irr	420	95
				ED F476-08	Irr	359	216
N 1784	ND	2316	-	F0523	Sd	2358	278
N 1832	ND	1938	58	M-02-14-002	SBdm(s)	1970	361
N 2217	ND	1612	93	E426-G001	SABm(s)	1804	111
				UA126	Sbc	1696	351
N 2223	ND	2718	-	E489-G050	S0	2892	143
				N2216	SABab(r)	2871	610
N 2336	ND	2204	111	I0467	SABc(s)	2042	199
				U03604	S	2158	753
				U04103	Sd	2133	1000
				U03671	dIrr	2292	1140
N 2339	ND	2261		2MASXJ07 ^g		2256	62
N 2366	ND	100	108	N2363	Irr	70	0.8
N 2545	ND	3384					
N 2835	ND	890	68	UA162	IBm(s)	850	157
N 2935	ND	2276	168				
N 3287	ND	1307	124	N3301	RSBa(rs)	1321	197
N 3504	ND	1540	95	N3512	SABc(rs)	1376	92
N 3513	ND	1194	62	N3511	SABc(s)	1106	53
N 3686	ND	1157	220	N3684	SAbc(rs)	1163	95
				N3691	SBb	1085	131
				N3681	SABbc(r)	1239	191
				LSBC D570-02	Im	1208	270
				LSBC D570-01	Sm	1019	286
				[RC3]112 ^g	Im	1067	388

Table 2: Large Scale Galaxy Nearest Neighbors^a

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation ^f kpc
N 3729	ND	1064	148	N3718	SBa(s)	993	57
N 3912	ND	1789	0	US:U422		1824	153
				U06791	Scd	1852	159
N 3953	ND	1047	148	U06840	SBm(rs)	1046	101
				N3917A	SA0	837	152
				N3917	SAd	965	204
				U06802	Sd	1256	219
				SB1147 ^g		1257	250
				U06983	SBcd(rs)	1082	265
				U06923	Im	1062	281
				U06940	Scd	1118	322
				N3992	SBbc(rs)	1048	353
				U06969	Im	1119	393
				U06956	SBm(s)	917	468
				U06922	Scd	877	469
				N4026	S0	930	479
				U06667	Scd	973	563
				U06917	SBm	911	576
				N4102	SABb(s)	846	577
				N3922	S0/a	906	655
				U06849	Sm	995	681

Table 2: Large Scale Galaxy Nearest Neighbors^a

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation ^f kpc
N 3992	ND	1053	148	U06940	Scd	1118	43
				U06969	Im	1119	54
				U06923	Im	1062	72
				U06983	SBcd(rs)	1082	209
				N3953	SBbc(r)	1047	354
				U06894	Scd	849	392
				N4102	SABb(s)	846	438
				U06840	SBm(rs)	1046	449
				N3917A	SA0	837	498
				N3982	SABb(r)	1109	521
				N4142	SBd(s)	1157	534
				N3917	SAcd	965	553
				U06802	Sd	1256	562
				N3972	SAbc(s)	852	582
				SB1147 ^g		1257	597
				N3998	SA0(r)	1040	616
				N3913	RSAd(rs)	954	659
				U06919	Sdm	1357	670
				N4026	S0	930	720
				U06956	SBm(s)	917	730
				SB1211 ^g		907	732
N 4123	ND	1327	0	N4116	SBdm(rs)	1309	102
				U07185	SAm(rs)	1296	359
				U07178	IABm(rs)	1339	496
				U07035	SBa(r)	1232	507

Table 2: Large Scale Galaxy Nearest Neighbors^a

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation f kpc
N 4214	ND	291	51	US:U480 NED29		268	0.1
				UA:276	Im	284	11
				N4190	Im	228	30
				KUG1207 ^g	S	339	70
				N4244	SAcd(s)	244	93
				U07559	IBm	218	149
				U07605	Im	309	165
				U07599	Sm	278	167
N 4236	ND	5		IRAS1214 ^g		95	2
				U07242	Scd	68	130
				U08201	Im	37	187
N 4242	ND	518	58	U07408	IAm	462	89
				U07320	dS0	521	106
				N4288	SBdm(s)	535	113
N 4385	ND	2150	55	DDO121	IBm(s)	2061	219
N 4435	ND	725	715	I3355	Im	162	64
				VCC0967	dE4	1135	76
				I3393	dE	476	87

Table 2: Large Scale Galaxy Nearest Neighbors^a

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation ^f kpc
				N4458	E0	635	103
				N4402	Sb	232	110
				VCC0916	dE	1115	126
				VCC0872	dE0	1183	128
				VCC0833	dE0	720	138
				VCC0854	dE8	684	153
				I3363	dE7	790	158
				N4387	E5	561	161
				VCC1001	I	338	187
				VCC0765	dE1	854	191
				I3349	dE1	1563	192
				M84	E1	1060	194
				M87	E0	500	223
				N4436	dE6	1124	224
				N4440	SBa(rs)	724	230
				N4431	SA0(r)	934	231
				N4477	SB0(s)	1355	234
				ARK363	dS0	125	235
				N4479	SB0(s)	876	237
				VCC0823	dE	1691	267
				N4486B	cE0	1555	267
				VCC0684	dE	537	270
				N4476	SA0(r)	1970	271

Table 2: Large Scale Galaxy Nearest Neighbors^a

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation ^f kpc
N 4487	ND	1037	106	N4504	SAcd(s)	1003	200
				UA289	SABdm(s)	991	396
N 4496A	ND	1732	124	VCC0985	BCD	1638	260
				I3474	Sd	1727	297
N 4535	ND	1956	715	VCC1514	dE7	532	109
				U07688	Im	609	138
				N4519A	dS0	1434	159
				VCC1455	I	1340	163
				VCC1675	S	1795	168
				N4492	SAa(s)	1774	245
				N4488	SB0(s)	980	257
				VCC1725	Sm III	1067	265
				N4522	SBcd(s)	2330	291
				VCC1596	I	1286	294
				U07802	Sdm	1788	305
				I3521	SBm pec	595	306
				VIII ZW 189		1350	311
				UA284	E	1155	314
				N4570	S0(7)/E	1730	335
				M49	E2	997	336
				VCC1199	E2	900	347
				N4471	E	809	351
				N4467	E2	1426	356
				N4483	SB0(s)	875	358

Table 2: Large Scale Galaxy Nearest Neighbors^a

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation f kpc
				N4470	Sa	2340	359
				I3487	E6	1157	361
				N4464	E3	1243	362
				I3617	SBm III	2088	375
				N4466	Sab	753	380
				I3430	Im III	2015	393
				I3518	dS0	1440	418
				I3591	SBm III	1632	422
				N4598	SB0	1961	429
				VCC1357	I	603	431
				U07596	Im	560	438
				N4578	SA0(r)	2273	459
				U07590	Sbc	1117	464
				U07580	S0(4)	716	467
				N4434	E0	1071	488
				I3576	Sm	1075	491
				N4532	IBm	2012	507
				N4451	Sbc	864	515
				VCC1804	Im	1898	523
				I3562	Im III	2051	523
				U07567	Im	867	524
				VCC1164	E	1040	525
				VCC1141	BCD	1040	532
				VCC0989	S	1846	535

Table 2: Large Scale Galaxy Nearest Neighbors^a

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation ^f kpc
				I3414	SABdm	543	548
				VCC1617	dS0	1607	553
				N4416	SBcd(rs)	1392	555
				Holm VII	Im	2039	557
				N4415	S0	910	560
				VCC1822	Im	1012	581
				N4411b	SABcd(s)	1270	583
				N4612	RSAB0	1875	584
				VCC0888	I	1096	584
				U07557	Sm	933	588
				N4623	SB0	1892	590
				VCC1013	I	1712	598
				N4411	SBc(rs)	1281	602
				VCC0867	I	1304	603
				N4543	E3	2464	615
				I3602	dE6	1279	617
				I3468	E1	1288	621
				I3412	I	764	636
				VCC1744	BCD	1150	638
				I3322	SABcd(s)	1194	641
				U07854	dE6	1032	650
				N4442	SB0(s)	532	654
				VCC1952	Im IV	1308	658

Table 2: Large Scale Galaxy Nearest Neighbors^a

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation ^f kpc
N 4654	ND	1037	715	VCC1605	S	1077	658
				VCC1661	dE0	1400	658
				VCC1933	S	2409	661
				N4417	SB0	843	678
				VCC1896	dSB0	1731	683
				I3322A	SBcd(s)	995	690
				VCC1993	E0	875	57
				N4639	SABbc(rs)	1010	85
				VCC1941	dE1	1213	93
				VCC1931	I	1100	99
				N4659	S0/a	510	116
				I3742	SBc(s)	963	128
				N4620	S0	1156	149
				I3735	E	1895	193
				I3718	S	849	234
				N4640	dS0	1931	255
				I3635	dE	1517	275
				U07906	Im IV	1010	296
				VCC1886	dE5	1159	305
				N4641	S0	2017	320
				N4689	SAbc(rs)	1616	330
				2MASXJ124 ^g	S0	1159	305
				VCC1816	Im IV	1006	342
				N4634	SBcd	297	354

Table 2: Large Scale Galaxy Nearest Neighbors^a

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation ^f kpc
				I3779	dE5	1193	372
				N4633	SABdm(s)	291	373
				N4584	SABa(s)	1779	403
				N4607	SBb	2257	413
				N4606	SBa(s)	1664	415
				I0809	E	206	422
				N4647	SABc(rs)	1422	453
				M59	E5	410	454
				M60	E2	1117	461
N 4688	ND	981		CGCG043-029	I	1051	32
				CGCG043-030	I	1040	108
				U07983	Im	694	210
				N4701	SACd(s)	723	302
N 4902	ND	2621	74	N4887	S0 pec	2687	117
				N4899	SBc(rs)	2658	389
				PGC045114	I	2612	443
				PGC045101	I	2555	440
N 4981	ND	1677	106	I4212	SBcd(s)	1485	402
N 5068	ND	671					
N 5792	ND	1924		CGCG020-040		1901	218
				U09601	SBcd(s)	1839	325
				U09682	SBm(s)	1815	826
				Mrk1390	S	1756	1020
				2MASXJ1457 ^g		1886	1080

Table 2: Large Scale Galaxy Nearest Neighbors^a

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation f kpc
N 5850	ND	2558	344	N5846A	cE2-3	2201	83
				CGCG021-015		2148	130
				CGCG021-011	S	2035	150
				N5846:62 ^g		2222	168
				N5846:39 ^g		2133	222
				N5846:33 ^g		2303	241
				CGCG021-009		1970	242
				N5846:28 ^g		1966	326
				N5846:49 ^g		2377	329
				N5846:17 ^g		2002	497
				U09760	Sd	2023	614
				N5869	S0	2087	631
				SD:J1506 ^g		2019	665
				U12588	Sdm	415	103
N 7640	ND	374	29	U12632	Sm	422	220
N 7723	ND	1861	0	MCG0260 ^g	SBd(rs)	1944	255
				N7727	SABa(s)	1855	293
				N7724	RSBb(r)	1927	305

Table 2: Large Scale Galaxy Nearest Neighbors^a

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation ^f kpc
N 7741	ND	753	20	U12791	Im	792	241

^a Extracted from NED (angular separation and systemic velocity) and T88 (members of groups).

^b Systemic velocity from HI observations (Huchtmeier & Richter 1989).

^c Probable velocity dispersion of galaxies in cloud or group (Tully 1987).

^d Nomenclature according to catalog, E:ESO; ED:ESOD; F:FGC; I:IC; LE: LEDA; M:MCG; N:NGC; SB:SBS; SD:SDSS; U:UGC; UA:UGCA; US: USGC

^e Systemic velocity of companion.

^f Calculated from angular separation (from NED) and distance.

^g IRAS1214: IRAS 12140+6947; KUG1207: KUG 1207+367; MCG0260: MCG-02-60-010; N5846:XX: NGC 5846[ZM98]00XX; [RC3]112: [RC3]1127.3+1642; SB1147: SBS 1147+520; SB1211: SBS 1211+540; SD:J143: SDSS J143950.03-004222.9; SD:J1506: SDSS J150634.25+001255.7; 2MASXJ07: 2MASX J07084902+1845271; 2MASXJ124: 2MASX J12412460+1210328; 2MASXJ1457: 2MASX J14575308+0056035;

^h Separation estimated from angular separation on the plane of the sky (from NED) but without redshift or systemic velocity information of NGC 6908; alignment is probably a chance superposition since the H α image from NGC 6907 shows no emission from NGC 6908 (García-Barreto et al. 1996).

Table 3: Companions within 10 and 20 diameters

Galaxy NGC/IC	Characteristic	Companions at $d \leq 10D^a$	Companions at $10D \leq d \leq 20D^b$
N 3185	Sy 2	3	1
N 3367	Sy 2-like, CNS, PM	0	1
N 3783	Sy 1	0	0
N 4477	Sy 2	4	0
N 4507	Sy 2	0	1
N 4725	Sy 2	3	4
N 5135	Sy 2, CNS	2	5
N 5347	Sy 2, CNS, NA	0	0
N 5728	Sy 2, CNS	0	0
N 6217	Sy 2, NA	0	0
N 6951	Sy 2, CNS, NA	0	1
N 7479	Sy 2	0	2
N 1022	CNS	0	2
N 1326	CNS	3	4
N 1415	CNS	2	5
N 3318	CNS	1	1
N 3351	CNS	2	6
N 4314	CNS	5	4
N 5430	CNS	0	1
N 1637	PM	0	0
N 2798	PM	2	1
N 3319	PM	0	0
N 4618	PM	2	1

Table 3: Companions within 10 and 20 diameters

Galaxy NGC/IC	Characteristic	Companions at $d \leq 10D^a$	Companions at $10D \leq d \leq 20D^b$
N 5534	PM	0	0
N 5597	PM	1	0
N 5691	PM	0	3
N 5757	PM	1	1
N 5915	PM	2	0
N 6907	PM	1	1
I 1953	NA, PM	1	2
N 2525	NA, PM	0	0
N 2787	NA	0	1
N 3359	NA	0	0
N 4561	NA	0	0
N 4691	NA	0	0
N 5669	NA	1	0
N 5921	NA	1	0
N 6239	NA	0	0
IC 5273	NA, PM	0	3
N 0672	ND	4	0
N 1784	ND	1	0
N 1832	ND	0	1
N 2217	ND	1	1
N 2223	ND	1	1
N 2336	ND	1	3
N 2339	ND	1	0

Table 3: Companions within 10 and 20 diameters

Galaxy NGC/IC	Characteristic	Companions at $d \leq 10D^a$	Companions at $10D \leq d \leq 20D^b$
N 2366	ND	1	0
N 2545	ND	0	0
N 2835	ND	1	0
N 2935	ND	0	0
N 3287	ND	0	1
N 3504	ND	1	0
N 3513	ND	1	0
N 3686	ND	3	3
N 3729	ND	1	0
N 3912	ND	0	2
N 3953	ND	8	10
N 3992	ND	5	16
N 4123	ND	1	3
N 4214	ND	4	4
N 4236	ND	2	1
N 4242	ND	2	1
N 4385	ND	0	1
N 4435	ND	7	19
N 4487	ND	1	1
N 4496A	ND	0	2
N 4535	ND	16	57
N 4654	ND	9	18
N 4688	ND	2	2
N 4902	ND	1	3

Table 3: Companions within 10 and 20 diameters

Galaxy NGC/IC	Characteristic	Companions at $d \leq 10D^a$	Companions at $10D \leq d \leq 20D^b$
N 4981	ND	0	1
N 5068	ND	0	0
N 5792	ND	2	3
N 5850	ND	9	4
N 7640	ND	2	0
N 7723	ND	0	3
N 7741	ND	0	1

^a Companions within a distance separation less than or equal to 10 diameters of a given bar galaxy; diameter of each galaxy and angular distances of companions to that galaxy taken from NED.

^b Companions within a distance separation between 10 and 20 diameters of the given bar galaxy

Table 4: Spiral Active Galaxies: comparison

Galaxy NGC/IC	Hubble Type	Characteristic ^a	Tully's Group ^b	Distance Mpc
N 1068	RSAb(rs)	Sy 1, CNS	52-2+1	14.4
N 1097	RSBb(r)	Sy 1, CNS, PM	51-3+1	14.5
M 82	S	Starburst	14-10	3.6 ^c
N 5548	RSA0(s)	Sy 1.5		68.9

^a Main Characteristic: Sy: Seyfert type; CNS: circumnuclear structure; PM: peculiar disk morphology.

^b T88; first digit specifies one of seven regions in T88, the second digit identifies a specific cloud within the general region; for a complete description refer to section 1 of this paper and Tully(1987) 14: Coma I Sculptur cloud; 51: Fornax cluster and Eridanus cloud; 52: Cetus-Aries cloud.

^c Cosmological distance taken similar to M81, 3.63 Mpc (Freeman et al. 1994).

Table 5: Nearest Neighbors^a of Active Spiral Galaxies

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation ^f kpc
N 1068	Sy 1	1140	75	2MASXJ024 ^g	Irr	1083	43
				U02162	IBm(s)	1185	344
				N1073	SBc(rs)	1211	356
N 1097	Sy 1, CNS, PM	1278	103	N1097A	E pec	1368	14
				E416-032	Sp	1221	195
				LS:F416-012	S	1076	303
				N1079	R1R2SABa(rl)	1447	352
M 82	Starburst	184	108	M81	Sab(s)	-34	39
				Holm IX	Im	46	41
				BK 03N	Im	-40	46
				U05423	Im	350	67
				N3077	I0 pec	14	73
				The Garland	Im	50	76
				N2976	Sc pec	3	121
				Holm I	Im(s)	143	124
				U05442	Im	-18	133
				HIJASSJ10 ^g		46	153
				U05692	Sm	180	194
				I2574	SABm(s)	57	199
				U05428	Im	126	204

Table 5: Nearest Neighbors^a of Active Spiral Galaxies

Galaxy NGC/IC	Characteristic	V_{sys}^b km s ⁻¹	V_{σ}^c km s ⁻¹	Companion ^d	Hubble type	V_{sys}^e km s ⁻¹	Separation ^f kpc
N 5548	Sy 1.5, PM	5165		U09165	S	5259	322
				CGCG133-031	Sbc	5358	365
				N5559	SBb	5166	525

^a Extracted from NED (angular separation and systemic velocity) and T88 (members of groups).

^b Systemic velocity from HI observations (Huchtmeier & Richter 1989).

^c Probable velocity dispersion of galaxies in cloud or group (Tully 1987).

^d Nomenclature according to catalog, E:ESO; I:IC; N:NGC; U:UGC.

^e Systemic velocity of companion.

^f Calculated from angular separation (from NED) and distance.

^g HIJASSJ10: HIJASS J1021+6842; MASXJ024: 2MASX J02420036+0000531;

Table 6: Companions within 10 and 20 diameters of spiral galaxies with known central activity

Galaxy NGC/IC	Characteristic	Companions at $d \leq 10D^a$	Companions at $10D \leq d \leq 20D^b$
N 1068	Sy 1	1	2
N 1097	Sy 1, CNS, PM	1	3
M 82	Starburst	6	7
N 5548	Sy 1.5, PM	0	3

^a Companions within a distance separation less than or equal to 10 diameters of the given bar galaxy.

^b Companions within a distance separation between 10 and 20 diameters of the given active galaxy

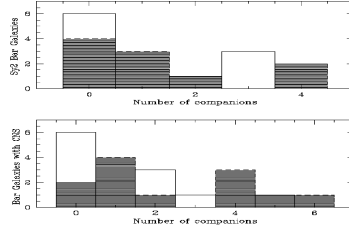


Fig. 1.— Histograms of number of bar galaxies being of Seyfert 2 type (Sy 2) and bar galaxies with circumnuclear structures (CNS) and their number of companions within 10 diameters (unfilled rectangles) and within a distance between 10 and 20 diameters (filled rectangles).

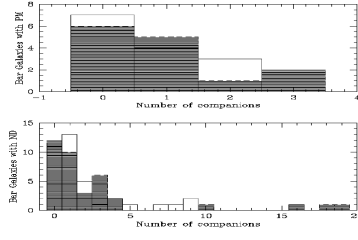


Fig. 2.— Same as in Figure 1 but for bar galaxies with peculiar disk morphology (PM) and normal disk (ND).

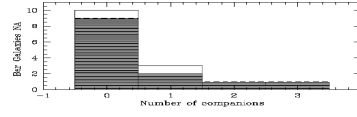


Fig. 3.— Same as in Figure 1 but for bar galaxies not associated with any large scale cloud of galaxies (NA).